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Attorney's Docket No. 5576-128

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Shima et al.
Appl. No.: 09/605,815
Filed: June 28, 2000
For: METHOD FOR REDUCING PULP TO POWDER AND PROCESS FOR THE PRODUCTION OF A CELLULOSE ETHER

Confirmation No.:
Group Art Unit: 1656
Examiner: S. Houtteman

November 16, 2001

Commissioner for Patents
Washington, DC 20231

RESPONSE

Sir:

This is in response to the Office Action mailed July 3, 2001, in the above-referenced application. Claims 1-6 are rejected under 35 USC § 103 as unpatentable over U.S. Patent No. 3,649,292 to Quame. Applicants respectfully traverse this rejection.

By way of background, pulp, such as cotton linter pulp and wood pulp, is ground by means of a grinder such as a knife mill. The resultant powdered pulp material is used in the production of various downstream products.

Grinding pulp using a conventional grinding apparatus, such as a knife mill, can be problematic. A knife mill relies upon shearing forces. The resultant powdered pulp will have a relatively long fibrous shape, which can be detrimental in downstream processing.

For example, in the production of cellulose ethers, the fibrous powdered pulp is contacted with an alkali to prepare an alkali cellulose. The alkali cellulose is subsequently dissolved in an aqueous solution. Because conventional powders prepared using a knife mill comprise long fibers, the resulting powder has a relatively small surface area per particle, thus limiting the available surface area for contact with the alkali. This can adversely affect the degree to which the alkali can permeate into the particles. If the alkali does not significantly permeate into the powdered pulp, the resultant alkali cellulose may not dissolve sufficiently in an aqueous solution. The residual insolubles can create processing problems as well as lower yields.

In addition, in a fibrous powder, the fibers intertwine with one another resulting in a

relatively large void volume and thus a low bulk density. Typically, equipment used in the production of cellulose ether has a fixed internal volume, and thus limited capacity as to the amount of material it can process in a given batch. This can in turn limit production of the end product.

In contrast to prior processes, the present invention provides a powdered pulp material having increased bulk density, thus allowing increased production. The invention also provides a pulp material having improved alkali permeation and thus reduced undissolved fibrous content in downstream production of cellulose ethers.

The inventors were the first to appreciate that the shearing forces implemented in traditional grinding processes resulted in a fibrous powder structure and the problems associated therewith. The inventors were also the first to address the problems associated with conventional grinding techniques by providing a different grinding motion in their process.

Specifically, in the invention, pulp is ground by means of a vertical roller mill, such as illustrated in Figure 1 of the present application. The grinding principle of such a roller mill involves compression and grinding forces, as well as shearing forces. As a result, the resultant powdered pulp has a different shape as compared to the elongated fibrous form of the powdered pulp produced using a knife mill.

Because the resulting powdered pulp includes shorter fibers, the powdered pulp has a lower void volume and thus a higher bulk density. Accordingly, a larger amount of the powdered pulp prepared in accordance with the invention can be used with a given reaction vessel having a fixed internal volume, as compared to powdered pulp prepared using a knife mill or other similar grinding means. See page 4, lines 10-18, and the paragraph bridging pages 6 and 7 in the present application. See also Table 1, which presents data illustrating average particle diameter and bulk density of the powders prepared in accordance with the present invention in contrast to powders formed using a knife mill.

The change in particle shape has also been found to improve permeation of an alkali material in the fiber. Thus, when the pulp is used in downstream processing, for example, dissolution in an aqueous medium, less waste results because more of the pulp fibrous material

will dissolve. Table 1 also illustrates improved alkali permeation as reflected by light transmittance data recorded therein.

The Quame patent does not teach or suggest the claimed invention. The Quame patent is directed to a method for producing a variety of products from a particular plant material, namely, plantain, with minimal waste. The products can include fibrous material, amorphous carbon, inorganic salts, an edible flour, and a powder that can be used as poultry feed or fertilizer.

The portion of the Quame patent relied upon by the Examiner (column 14, lines 1-5) does not describe any type of grinding process, much less the claimed process. Column 11, lines 41-59 describes the process step relied upon by the Examiner. A milky liquid recovered from a slurry of processed vegetated matter is combined with an agglutination agent to form a pulp-containing gel. The pulp is separated from the liquid, dried and ground to form a powder stated to be useful as poultry feed or fertilizers. The Quame patent nowhere, however, teaches the type of grinding used to make the feed material, much less suggests a particular type of apparatus such as that claimed.

Further, there is no motivation to one skilled in the art to select a grinding mechanism which combines different compression, shearing, and grinding forces so as to provide a powder having a particular particle size and shape. At best, the Quame patent would lead the skilled artisan to use grinding process relying upon a shearing motion. In this regard, Figure 1 of Quame illustrates a pilot plant used for recovery of products from plantain. The plant includes a "conventional" mill **22** which consists of "a heavy-duty Waring blender" which includes a container constructed of "four lobed cross section to produce forceful flow of the material into the rotating blades." See column 6, lines 18-32. Thus, the Quame patent teaches grinding using an apparatus similar to a knife mill in which the grinding action is a shearing motion. As a result, the end product will have an elongated fibrous shape.

In summary, the Quame patent is concerned with a different problem than that addressed by the present invention, namely, extracting numerous products out of a single natural resource, namely, plantain vegetative matter. The Quame patent does not recognize the problems associated with the use of pulp material in the production of a cellulose ether, much less the

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